CLAIMS

1. A system for imaging of a sample, comprising:

a plurality of detectors which are each focussed at a respective focal plane in a sample volume; and

light selection optics positioned between the plurality of detectors and the sample volume, the light selection optics for transmitting to the detectors a portion of light originating at the respective focal planes while screening out light which originates from outside of the respective focal planes.

2. The system of claim 1, wherein the light selection optics includes a plurality of ON regions and OFF regions, the ON regions transmitting the light from the respective focal planes and the OFF regions blocking the light from the respective focal planes.

3. The system of claim 1, wherein a pulse laser provides multiphoton fluorescence.

4. The system of claim 1, wherein the ON regions can be controllably changed to OFF regions and the OFF regions can be controllably changed to ON regions.

5. The system of claim 1, wherein the light selection optics provide each detector with a degree of confocality.

6. The system of claim 4, wherein a pattern of ON and OFF regions controls the degree of confocality provided to the view from each detector.

7. The system of claim 4, wherein the light selection optics concurrently provide the degree of confocality to each of the detectors in the plurality of detectors.

8. The system of claim 1, wherein the light selection optics includes a plurality of mirrors which can occupy an ON position or an OFF position, the ON regions transmitting the light from the respective focal planes and the OFF regions blocking the light from the respective focal planes.

9. The system of claim 1, wherein each detector is focussed on a different region of the sample and the light selection optics selects the portion of each region which is viewed by the detector focussed on the region.

10. The system of claim 1, further comprising:

focus differentiation optics which causes each detector to be focussed at the different depths within the sample.

11. The system of claim 9 wherein the focus differentiation optics can be adjusted so as to alter where a detector is focussed within the sample.

12. The system of claim 9, wherein each detector is positioned equidistant from the focus differentiation optics.

13. The system of claim 11, wherein the material of the focus differentiation optics has at least one first side and a plurality of second sides, each second side being positioned at a different distance from the at least one first side.

14. The system of claim 13, wherein each second side is substantially parallel to one of the at least one first side.

15. The system of claim 1, further comprising:

a light source and optics configured to illuminate the sample with a light which causes a dye in the sample to fluoresce.

16. The system of claim 1, further comprising:

a light source and optics configured to illuminate the sample and transfer reflected light from the sample to the detectors.

17. The system of claim 1, further comprising:

relay optics position between the light selection optics and the detectors.

18. The system of claim 1, further comprising:

magnification adjustment optics positioned between the detectors and the light selection optics, the magnification adjustment optics compensating for differences in magnification in the view from each detector.

19. The system of claim 1, further comprising:

a sample fixture for holding the sample being viewed, the sample fixture configured to scan the sample relative to the light selection optics.

20. The system of claim 1, further comprising:

a processing system for processing and display of outputs of the detectors simultaneously as a three dimensional image.

21. The system of claim 1, wherein each detector includes an area array sensor.

22. The system of claim 21 wherein each detector is electrically controlled to produce time-delay-and-integration.

23. The system of claim 1, wherein the selection optics increase the ratio of intensity of light received at the detector which originates from the associated focal plane to the intensity of light received at the detector which originates from outside the associated focal plane.

24. A method for imaging a sample, comprising:

providing a plurality of detectors;

focussing each of the detectors at a respective focal plane within a sample volume; and

transmitting to the detectors a portion of light originating at the respective focal planes while screening out light which originates from outside of the respective focal planes.

25. The method of claim 24, further comprising:

moving the sample so at least a portion of the sample is scanned by the ~~detectors.~~

26. The method of claim 24, further comprising:

providing output from each detector to a processing, display and storage system.

27. The method of claim 24, further comprising:

filtering the output from each detector to provide 3D filtered output.

28. The method of claim 27 further comprising utilizing the processing system to segment the 3D image into 3D objects.

29. The method of claim 28 utilizing the processing system to classify the objects into types of objects based on measurements processed from the 3D object segments.